Abstract

Condition evaluation of timber piles is currently based on traditional methods of visual inspection and sounding. Unfortunately, this method is vague and in many cases relies on interpretation of information and not on measurable parameters. Because nondestructive evaluation (NDE) using stress waves provides a fast and relatively inexpensive way of predicting the condition of in-service structural systems, these techniques have become an increasingly common tool for field evaluation of structural components. In this research, the bending wave technique has been used to measure wave propagation parameters for installed timber piles. Both laboratory and in-situ piles were tested in various conditions (i.e., liquid content and damage degree). The results were used to formulate analysis and testing procedures for quantitatively determining the condition of timber piles.

In this research, a high correlation between stress wave parameters and the condition of timber was found. Stress wave properties measured in the time domain, more specifically the phase velocities, are effective indicators of the remaining sound cross-sectional area of timber pilings. Properties of stress wave propagation obtained from the frequency domain are unreliable and are sensitive to natural structural variations of timber. A strong relationship was observed between the phase velocities and liquid contents for intact sections. Controlled laboratory data from damaged pile sections were used in conjunction with information obtained from field specimens to develop a condition prediction model. In predicting the remaining cross-sectional area of field specimens, the prediction model yielded conservative results in 30% of the cases. A qualitative reject/accept criterion was also developed that distinguishes between intact and damaged pile sections.

A field testing procedure evolved during the course of this research. The testing methods (that are utilized to obtain appropriate stress wave properties used to predict pile condition) as well as analysis procedures are presented. Additional testing of installed timber piles will allow for the improvement of the current analysis procedures and methods.